PCT/EP+ 99/01391
EPO - DG 1
12 06. 1999

REPUBLIKA SLOVENIJA
Ministrstvo za znanost in tehnol[illegible]

URAD REPUBLIKE SLOVENIJE ZA INTELEKTUALNO LASTNINO

EP99/1391

Potrdilo

Certificate

Urad Republike Slovenije za intelektualno lastnino potrjuje, da je priloženi dokument istoveten z izvirnikom prijave patenta, kot sledi:

Slovenian Intellectual Property Office hereby certifies that the document annexed hereto is a true copy of the patent application, as follows:

(71) Prijavitelj (*Applicant*):

BIA d.o.o., Teslova 30, 1111 Ljubljana, Slovenija

(22) Datum prijave (*Application Date*):

27.2.1998 (27.feb.1998)

(54) Naziv (*Title*):

Ohišje za porozne cevne module

(21) Številka prijave (*Application No.*):

P-9800058

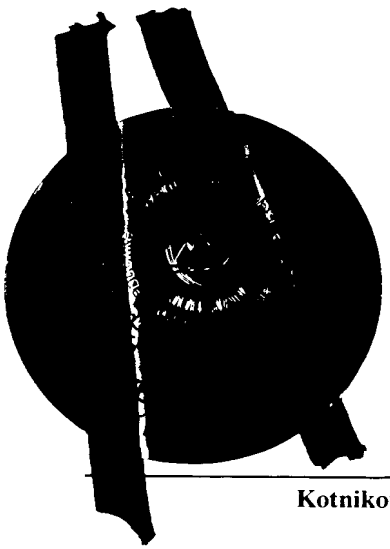
Ljubljana, 23.2.1999

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

za Urad Republike Slovenije
za intelektualno lastnino

Janez Milač, dipl. ing.

REPUBLIKA SLOVENIJA MINISTRSTVO ZA ZNANOST IN TEHNOLOGIJO Urad Republike Slovenije za intelektualno lastnino LJUBLJANA



PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Kotnikova 6, 1001 Ljubljana, p.p. 206, telefon: 061/178 3000, faks: 061/178 3111

OHIŠJE ZA POROZNE CEVNE MODULE

Predmet izuma je konstrukcija ohišja iz kemijsko inertne in mehansko odporne polimerne mase, ki omogoča uporabo večjih cevnih modulov iz poroznega material za preparativno ločitev in vezavo biomolekul.

Kompaktni porozni cevni moduli se uporabljajo v kromatografiji visoke ločljivosti kot alternativa preparativnim kolonam, ki so polnjene z delci različnih velikosti. Proces preparativne ločitve različnih komponent na koloni je omejen s hitrostjo difuzije mobilne faze v pore delcev, kjer prihaja do interakcij med molekulami komponent v mobilni fazi in aktivnimi skupinami na delcih. Ker je difuzija dokaj počasen proces, je običajno tudi čas analize s kolonami precej dolg. Poleg tega je delo s kolonami zahtevnejše, saj je tehnika polnjenja le-teh kompliciranа, ob nepravilnem ravnanju pa kolona lahko hitro izgubi svoje lastnosti. V primeru kompaktnih poroznih cevnih modulov, poteka ločitev komponent v vzorcu na osnovi konvektivnega prenosa snovi, kar čas analize občutno skrajša. Zaradi velikih por v materialu je tudi padec pritiska zelo majhen.

Porozni cevni moduli temeljijo na kompaktnem poli(glicidilmetakrilatu-etilenglikoldimetakrilatu), katerega priprava je opisana v patentih US 4889632, US 4923610 in US 4952349. Za delo s tem materialom v obliki diskov je že bilo narejeno posebno ohišje (patentna prijava št. P-9700156). Princip prenosa analitskih enot v večje merilo bi lahko na osnovi tega temeljil na povečevanju premera in/ali debeline diska. Pri tem pa nastopijo veliki problemi zaradi krhkosti samega materiala, zaradi slabše porazdelitve tekočine po celotni površini večjega diska kot tudi do mehanskih problemov materiala med kemijsko modifikacijo, kjer so absolutni raztezki materiala, ki med modifikacijo nabreka tako veliki, da prihaja do mikrorazpok v sami strukturi diska.

Po izumu so zgoraj navedeni problemi rešeni z izvedbo ohišja predstavljenega na slikah 1 in 2. Ohišje je v tem primeru prirejeno za polimerni porozni cevni modul 10 (slika 5). Polimerni material ima zaradi visoke poroznosti veliko specifično površino prekrito s kemijsko reaktivnimi skupinami, kar omogoča ločitev različnih biomolekul.. Le-ta je vstavljen v telo ohišja 6 (slika 1). Ohišje 6 (slika 1) ima na notranji strani izstružen navoj določene dolžine 12 (slika 4), ki mora biti večja od dolžine cevnega modula 10 (slika 5). Na spodnjem delu ohišja 6 mora polimerni cevni modul segati preko konca navoja v dolžini 2-3 mm, na zgornjem delu pa mora ostati še 10-15 mm navoja nad zgornjim robom cevnega modula. Na spodnji del cevnega modula 6 je

potrebno pritrditi ploščico iz inertnega polimernega materiala premera, enakega premeru modula in debeline 2-3 mm, ki ima na sredini zvrtano luknjico premera 1-2 mm. Na zgornji del modula je potrebno pritrditi enako ploščico, ki pa nima zvrtane luknjice. Na zgornji strani je potrebno zatem vstaviti batek 8 (slika 1), ki ima od navoja za priključitev do določene globine zvrtano luknjico premera 1-2 mm (slika 3). Od te globine je luknjica zvrtana pravokotno v radialni smeri do izhoda na obodu batka, ki je v posebej izstruženem kanalčku, glej sliko 3. Ta batek služi kot usmerjevalnik tekočine v navoj na notranji strani telesa ohišja 12 (slika 4). Na določeni višini batka je izstruženo ležišče za o-ring 7 (slika 3), ki mora biti dovolj visoko, da sega nad izstružen navoj 12 (slika 4) na notranji strani telesa ohišja 6 (slika 1). Ta o-ring preprečuje puščanje tekočine iz samega ohišja med delom pri povišanih tlakih. Na spodnjo stran ohišja za cevni modul 6 (slika 1) je batek 2 (slika 1), ki služi kot zbiralnik tekočine. Na čelni ploskvi batka 2 (slika 1) je izvrtanih dvoje ležišč za o-ring 3 in 4 (slika 6). O-ringa 3 in 4 (slika 6) preprečujeta tekočini, da bi šla direktno iz navoja 12 (slika 4) skozi luknjico batka. Na ta način je tekočina prisiljena vstopati skozi porozno steno cevnega modula 10 (slika 5), kjer se nato zbira v notranji luknjici ter gre šele nato skozi batek 2 (slika 1). Podobno kot zgornji batek 8 (slika 1) ima tudi spodnji batek 2 (slika 1) na obodu o-ring 5 (slika 6), ki preprečuje puščanje tekočine iz ohišja 6 (slika 1). Ohišje za porozni cevni modul 6 (slika 1), ima na zunanji strani navoj, ki služi za pričvrstitev matic 1 in 9 (slika 1). Po izumu se ob privijanju matic batka 2 in 8 (slika 1) pomikata v aksialni smeri in vsak s svoje strani zatesnita vtok in iztok tekočine v polimerni cevni modul 6 (slika 1). Izgled sestavljenega ohišja prikazuje slika 2.

za BIA d.o.o.

Aleš ŠTRANCAR

PATENTNI ZAHTEVEK

1. Ohišje za porozne cevne module

označeno s tem,

da je sestavljeno iz votlega valjastega telesa (6, slika 1) z navojem na zunanji in notranji strani (12, slika 4), dveh batkov (2 in 8, slika 1) z luknjico (slika 3 in 6) in navoji za priključitev (11, slika 6) ter dveh matic (1 in 9, slika 1).

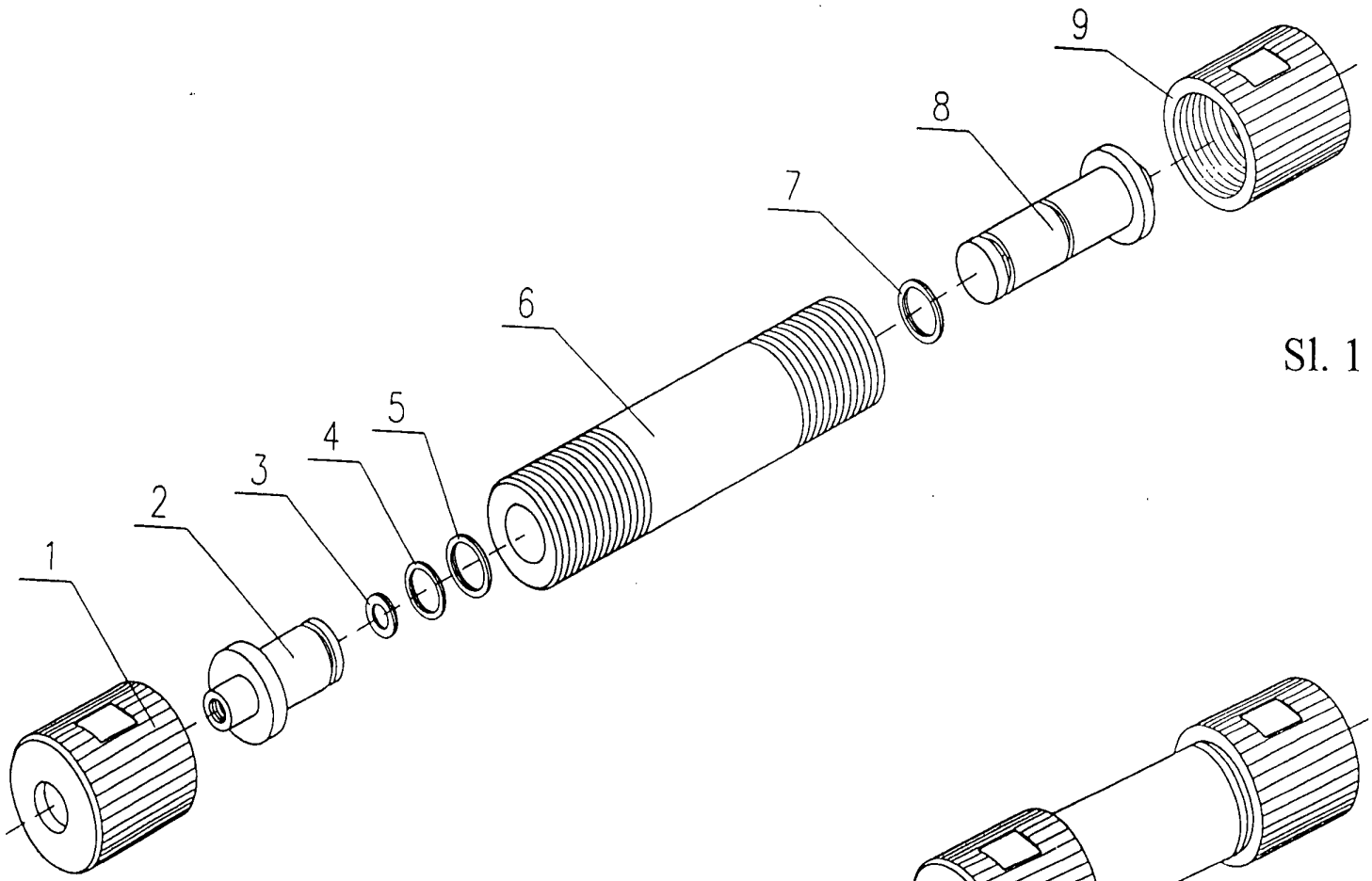
za BIA d.o.o.

Aleš ŠTRANCAR

IZVLEČEK

Ohišje za porozne cevne module rešuje problem mehanske stabilnosti le-teh in omogoča dobro porazdelitev tekoče faze po čimvečjem deležu celotnega volumna poroznih cevnih modulov. Slednji predstavljajo prenos analitskih poroznih diskov v večje merilo in so namenjeni za hitro preparativno ločitev in analizo biomolekul.

Ohišje na sliki 1 je sestavljeno iz votlega valjastega telesa z navojem na zunanji (6, slika 1) in notranji strani (12, slika 4), v katerega vstavimo cevni modul (10, slika 5). Cevni modul (10, slika 5) leži med dvema batkoma (2 in 8, slika 1), ki imata luknjico (slika 3 in 6), navoje za priključitev na zunanji strani (11, slika 6), razširitev (slika 3 in 6) potrebno, da matici (1 in 9, slika 1) pri zatiskanju nanju naležeta ter s tem fiksirata bateka (2 in 8, slika 1).



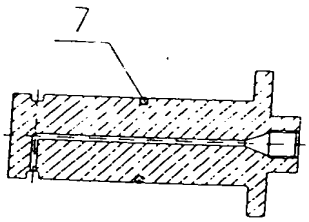
Sl. 1

Sl. 2

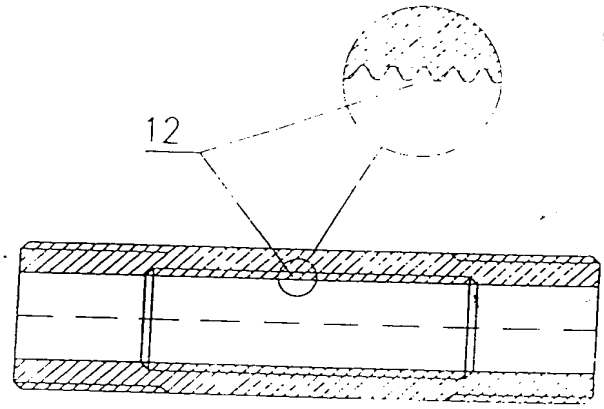
za BIA d.o.o

Aleš ŠTRANCAR

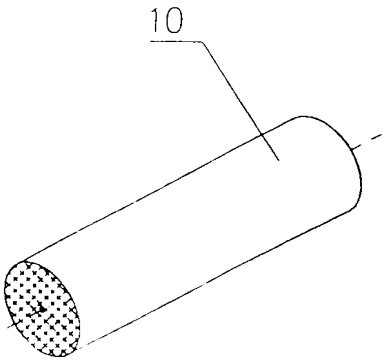
06-90-21



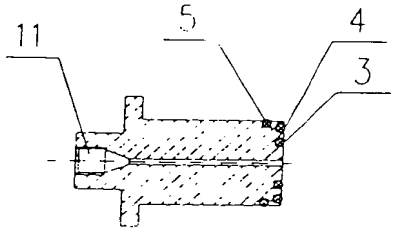
Sl. 3



Sl. 4



Sl. 5



Sl. 6

za BIA d.o.o

Aleš ŠTRANCAR

(Coat-of-arms of the Republic of Slovenia)

REPUBLIC OF SLOVENIA

Ministry of Science and Technology

INTELLECTUAL PROPERTY OFFICE

OF THE REPUBLIC OF SLOVENIA

C E R T I F I C A T E

The Intellectual Property Office of the Republic of Slovenia hereby certifies that the document enclosed hereto is a true copy of the Patent Application, as follows:

(71) *Applicant:*
BIA Ltd., Teslova 30, 1111 Ljubljana, Slovenia

(22) *Application Date:*
February 27, 1998

(54) *Title:*
Housing for Porous Tubes

(21) *Application No.:*
P - 9800058

Ljubljana, February 23, 1999

For the Intellectual Property Office
of the Republic of Slovenia
(Signature)
Janez Milač, BE

Rubber Stamp: (round)
REPUBLIC OF SLOVENIA
MINISTRY OF SCIENCE AND TECHNOLOGY
The Intellectual Property Office of the Republic of Slovenia
LJUBLJANA
(Coat-of-arms of the Republic of Slovenia in the centre, the number 13 and a star at the bottom)

Kotnikova 6, 1001 Ljubljana, P.O.Box 206,
telephone no.: 061 / 178 3000, facsimile no.: 061 / 178 3111

HOUSING FOR POROUS TUBES

The object of the invention is a housing structure from a chemically inert and mechanically resistant polymer mass that allows the usage of larger tubes from porous materials for the preparatory separation and binding of biomolecules.

Compact porous tubes are used in high performance liquid chromatography (HPLC) as an alternative to preparatory columns that are filled with different size particles. The preparatory separation process of different components on the column is limited by the mobile phase diffusion velocity into particle pores, where interactions between component molecules in the mobile phase and active groups on particles occur. The analysis time with columns is customarily quite long, as diffusion represents a rather slow process. Besides, work with columns is more demanding as their filling technique is complicated, and when improperly handled a column can quickly loose its properties. In the case of compact porous tubes, the separation of components in the sample is carried out based on the convective transmission of the substance, all of which perceptibly shortens the time of analysis. Likewise, the pressure drop is very small because of the large pores in the material.

Porous tubes are based on compact poly(glycidyl methacrylate - ethylene glycol dimethacrylate), the preparation of which is described in patents US 4889632, US 4923610, and US 4952349. A special housing had already been made for work with this disk-shaped material (patent application no. P - 9700156). The principle of transference of analytic units into a larger scale

could, based on this, be founded on the increase of the diameter and/or thickness of the disk. It is at this point that great problems arise due to the brittleness of the material itself, because of the worse distribution of liquid over the entire surface of the bigger disk, as well as on account of mechanical problems related to the material during the chemical modification, where absolute tensilities of the material, that intumesces during modification, are so great as to cause micro-fissures in the disk structure itself.

According to the invention, the above mentioned problems are solved with the construction of a housing, as depicted on pictures 1 and 2. In this case the housing is prepared for a polymer porous tube 10 (picture 5). Due to its high porosity the polymer material has a large specific surface covered with chemically reactive groups, all of which enables the separation of different biomolecules. It is inserted into the housing structure 6 (picture 1). The housing 6 (picture 1) has an internal screw thread that had been tapped, which has a certain length 12 (picture 4) that has to exceed the length of the tube 10 (picture 5). On the lower part of housing 6 the polymer tube must extend over the end of the screw thread for a length of 2-3 mm, while on the upper part 10-15 mm of screw thread has to be left above the upper edge of the tube. It is necessary to affix a small plate from an inert polymer material to the lower portion of tube 6, having a diameter equalling the diameter of the tube and a thickness of 2-3 mm, with a small bore having a diameter of 1-2 mm in the centre. An identical small plate must be affixed to the upper portion of the tube, with the difference that it does not have a small bore. A small piston 8 (picture 1) should

then be inserted on the upper side, having a small bore with a diameter of 1-2 mm (picture 3) running from the connection screw thread up to a certain depth. From this depth a small bore is drilled at a right angle in the radial direction, up to the exit on the rim of the small piston located in a separately cut channel (see picture 3). This small piston serves to direct the liquid into the internal screw thread of the housing structure 12 (picture 4). On a certain height of the small piston an o-ring bed was cut out 7 (picture 3), that has to be high enough to reach above screw thread 12 (picture 4) on the internal side of housing 6 (picture 1). This o-ring prevents liquid leakage from the housing itself during work at higher pressures. A small piston 2 (picture 1) is located on the lower side of housing 6 (picture 1), that serves as a liquid collector. On the front face of the small piston 2 (picture 1) two beds are drilled for o-rings 3 and 4 (picture 6). O-rings 3 and 4 (picture 6) prevent the liquid from going directly from screw thread 12 (picture 4) through the small bore of the piston. In this way the liquid is forced to enter through the porous wall of tube 10 (picture 5), where it accumulates thereupon in the small internal bore, and only then it passes through small piston 2 (picture 1). Resembling the upper small piston 8 (picture 1), the lower small piston 2 (picture 1) has likewise an o-ring 5 (picture 6) on the rim, preventing the leakage of liquid from housing 6 (picture 1). The porous tube housing 6 (picture 1) has on its external side a screw thread serving for the fastening of nuts 1 and 9 (picture 1). According to the invention, on the tightening of the nuts the small pistons 2 and 8 (picture 1) move in the axial direction and, each from its own side, seal the inlet and outlet for liquid in the polymer tube 6 (picture 1). Picture 2 depicts the

appearance of the assembled housing.

for BIA Ltd.

(signature)

Aleš ŠTRANCAR

PATENT APPLICATION

1. Porous Tube Housing

marked by the fact,

that it is made up of a hollow cylindrical body (6, picture 1) with a screw thread on both the external and internal sides (12, picture 4), two small pistons (2 and 8, picture 1), with a small bore (pictures 3 and 6), as well as screw threads for connection (11, picture 6), and two nuts (1 and 9, picture 1).

for BIA Ltd.
(signature)
Aleš ŠTRANCAR

SUMMARY

The housing for porous tubes solves the problem in conjunction with mechanical stability of these tubes and enables a good distribution of the liquid phase over the greatest possible portion of the total volume of porous tubes. The latter represent a transference of analytic porous disks into a larger scale, their purpose being a fast preparatory separation and analysis of biomolecules.

The housing on picture 1 is made up of a hollow cylindrical body, with screw threads on the external (6, picture 1) and internal sides (12, picture 4), into which a tube is inserted (10, picture 5). The tube (10, picture 5) lies between two small pistons (2 and 8, picture 1) that have a small bore (pictures 3 and 6), screw threads for connection on the external side (11, picture 6), and a dilatation (pictures 3 and 6) necessary for the nuts (1 and 9, picture 1) to lean against them during closure, fastening the small pistons (2 and 8, picture 1) in the process.